RAindrops

Robert Allan Ltd. Information & News Issue 12

THE COST-EFFECTIVE TUGBOAT

ROBERT ALLAN LTD.
NAVAL ARCHITECTS AND MARINE ENGINEERS

Introduction

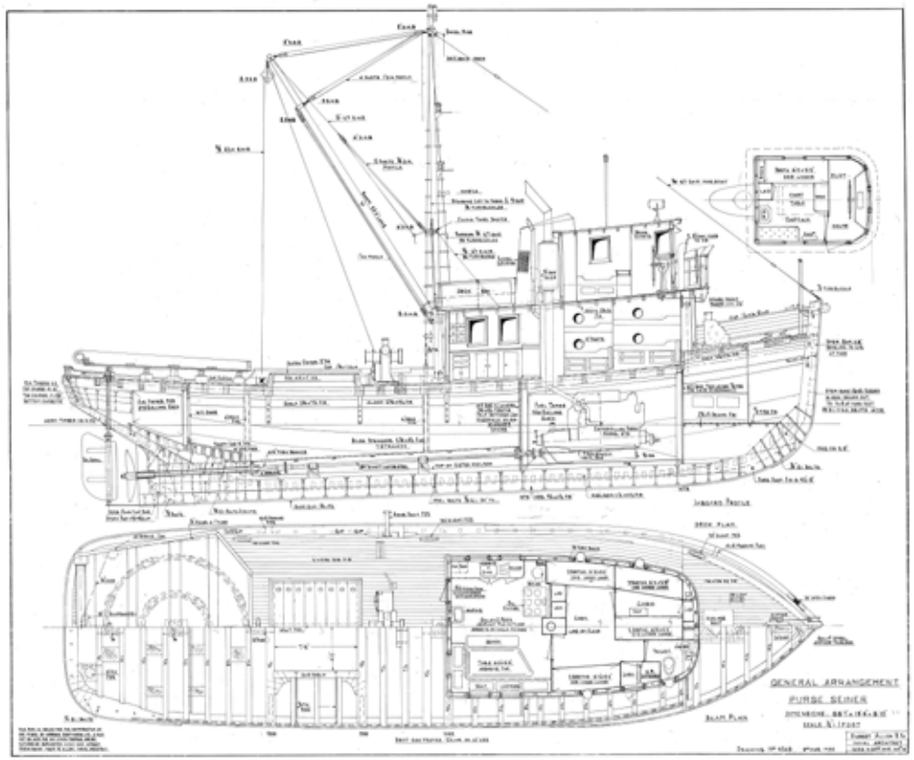
History, Safety, Efficiency, Optimization, …and Change

by: Robert G. Allan, P. Eng.
Executive Chairman of the Board

I spent quite a bit of time recently digging through our archives, trying to identify a fishing boat that my Grandfather "may" have designed. The grandfather of a local engineer worked on this vessel and indeed was one of 8 fishermen who died on it during a violent storm in 1961. The background data this man had did not quite match the information on the only drawings I had. They were "close", but not close enough. The 65' seiner ***Northview*** was built in 1951 at Harbour Boatyards, a small, local shipyard which no longer exists. In fact the condominium in which I now live sits on a piece of land which, when I was a child trailing around shipyards with my father, was covered with numerous similar small and productive yards building fishboats, small tugs and similar craft for local marine industries.

The world was a much smaller and gentler place in those days. Our business was entirely dependent on the local economy and the ebb and flow of the forest and fishing industries for the most part. It was enough to support those two Robert Allan's, working in the basement of their home! I am often asked (and often wonder) how they would feel seeing the industry-leading design organization which has grown out of their early efforts, entirely based on a foundation of simply doing the best work they could and treating their Clients with honesty and respect. It is a pretty simple formula and one I have always tried to live by, and I believe that message is still embodied in those who work in this office today. Andra has summarized very effectively what a terrific team of people we have working together in this office. Everyone here is focussed on doing their best, and helping each other to always try harder and to do better. We nearly always have fun in the process too!

We focus in this issue on being cost-effective in every aspect of the design, construction and operation of tugs (equally applicable to any floating thing!). We look at saving energy and how to measure those savings for the benefit of all. These themes are not new actually: my late Father wrote numerous papers in the 1960's and '70's on these very subjects… it just seems no-one was listening too closely! Looking at the lines of these vintage fishboats also reminded me how easy it is to reduce the energy needed for propulsion simply by good design… it IS what we were trained to do!



We also look at how to design and build smarter, reducing the energy involved in construction. Just a few weeks ago I had the distinct pleasure of touring through Sanmar's two new shipyards in Turkey and seeing 14 of our tugs in various stages of construction in one of the world's most progressive small shipyards. What a wonderful feeling to see how the teamwork between our two companies has led to such a successful enterprise across the globe, and more importantly to know that the care which goes into construction at Sanmar so accurately reflects our own objectives in the design. …And then Rollie pulls up some history of mass production of tugs in Canada during the last war which would put any modern shipyard to shame! It is a strong reminder of what teamwork can do when we share common goals.

And not least, we pay a too small tribute to Hans Muhlert, a man who has dedicated his professional life to this company and has contributed incredibly to our long term success.

Oh… and the ***Northview***? After a lot of checking we concluded that indeed the plans drawn by my Grandfather in 1950 were for this boat. The length discrepancy was the difference between overall and "registered" length; the beam difference was not large and could have been due to measuring over fender strakes rather than the primary planking, and the depth difference I attributed to the difference between the moulded depth and depth to USK… or possibly the builder just changed it all! (Sometimes they do that!) The original lovely pen and ink drawing of this boat was scanned and sent to the grandson of the crewman who sailed on her, to give to his Father for Christmas.

For me that was a very happy ending!

Hans Muhlert – 45 Years & Counting!

Robert Allan Ltd. has been extremely lucky to have the talented Hans Muhlert dedicate his entire professional career to this company, for the past 45 years. Hans joined the company as a fresh graduate of the University of Michigan in 1970, and still works here almost daily, now mostly patiently guiding the efforts of our younger generation of naval architects. Hans is a highly skilled and versatile naval architect and has been our "go-to" person on any aspect of ship propulsion and performance prediction for many years. He has a diverse range of interests in the field of ship design, from sailing craft to fast power boats to tugs and research vessels. He has always been our "fast boat" designer. Hans also brought to the company in his early years a skill set for transportation analysis which still exists as the basis of much of that sort of work which we do today.

His commitment and dedication to Robert Allan Ltd. cannot ever be properly acknowledged, but this special anniversary of his time here could not pass without a most sincere "Thank You" for everything he has done in support of the growth and reputation of our company.

No 'I' in Team

by: Andra Papuc
Project Manager/Naval Architect

Two recent events in the Canadian landscape have reminded me of how fortunate I am to be working in this particular naval architecture design office in beautiful Vancouver, B.C.

Firstly, in celebrating the Thanksgiving holiday we all took a well-deserved long weekend to relax and recharge. Although it was nice to get a break from the often fast paced and challenging office environment, I found myself reflecting on my last seven years with Robert Allan Ltd. and giving thanks for not only the experiences and opportunities I have been given during that time, but most importantly for the people I interact with daily and can honestly call my friends and mentors. I realized I spend more time with my co-workers than with my family and friends, so in many ways they have become my 'work family'.

Secondly, Canadians took to the polls for the federal election, reaching the highest levels of voter turnout since 1993. As I watched the election coverage I felt united with all my fellow Canadians, and specifically with my co-workers. The Robert Allan Ltd. work family comprises 85 members from over 17 different nationalities, merging a great wealth of knowledge from their varying backgrounds and experiences. Although individually we each have a great deal to offer, the real gain is in the collective, in sharing those experiences and learning from each other. I rely on my co-workers daily for support and advice, and hope I can offer the same in return. At the risk of sounding cliché, every day I sit down at my desk I am reminded that there is no 'I' in TEAM, and I cannot think of a team that I would be prouder to be part of.

Optimizing Fuel Consumption

by: Erik Johnston, P. Eng.
Project Manager/Mechanical Engineer

Despite the current low price of fuel, now may be a good time for vessel operators to consider re-investing the savings they are experiencing at the fuel pump to position themselves to operate more efficiently when fuel prices do eventually return to historical norms. In jurisdictions with carbon (CO2) or NOx tax schemes, there are additional financial incentives to reduce emissions by simply burning less fuel. The relatively high cost of ultra-low sulphur fuels to meet the stringent SOx limits within Emissions Control Areas (ECAs) are also pushing operators to taking a closer look at where fuel savings can be had.

Reducing vessel speed (slow steaming) is often the simplest method of reducing fuel consumption with existing vessels. But if this is not feasible due to operational constraints, there are other options well worth considering, such as:

- Maintaining clean & polished propellers
- Regular and frequent in-water hull cleaning
- Building a smoother hull (i.e. by minimizing plate distortion, grinding welds smooth, etc.)
- Re-powering with modern efficient main and auxiliary engines
- Using low resistance anti-fouling coatings
- Careful examination of the resistance of appendages such as bilge keels etc.

Special care in developing the hull shape to reduce resistance or improve flow into the propeller is a great way to optimize propulsive efficiency. Model tank testing is a tried and true method for predicting performance, but is often a slow and expensive process. With the advent of Computational Fluid Dynamics (CFD) a larger number of design variants can be evaluated and compared against each other in relatively short time (weeks instead of months) for a fraction of the cost. Robert Allan Ltd. has conducted a number of CFD analyses in recent years to optimize vessel performance including: Articulated Tug/Barges (ATBs), shallow draft river towboat and barge convoy systems, research vessels, search and rescue vessels, etc.

Vessel operators are recommended to take advantage of this opportunity provided by current low fuel prices by investing in your fleet. Whether it is a little 'TLC' for existing vessels, or initiating a fleet renewal program, spending a little now will pay dividends by reducing fuel consumption and emissions with the added benefit of making operations more competitive.

CAPEX – OPEX Evaluations for Cost-effective Tug Design

by: Fuzz Alexander
Senior Project Engineer

The primary design goals of mission function and a safe and aesthetic vessel configuration can be supplemented by evaluations of CAPEX – OPEX variations for design options. Potential design trade-offs of CAPEX vs. OPEX are project specific and dependent on the Owner's business case for weighting of immediate capital costs vs. long-term operating costs.

Construction costs are variable throughout the world and some structural design can be weighted to optimize the material and labour contributions to CAPEX when the build location is known. Machinery choices and CAPEX – OPEX contribution for propulsion, generation and deck machinery configurations are typically both cost and efficiency sensitive. The significance of consumables and maintenance to OPEX will vary greatly depending on the average annual runtime and average load profile. For most harbour and escort duty tugs the fuel efficiency at 10% to 50% propulsion thrust is more important than at rated thrust, whereas for pusher or towage tugs fuel efficiency at 40% to 80% thrust is usually more important. Fuel and related consumables usage and cost can be well defined from the expected operating profile. Representative maintenance costs can be made and factored into a "best guess" annual OPEX cost based on an appropriate cost escalation factor. Crew and shore support costs are usually not included in the evaluation but can be considered if design choices may have an impact on these requirements. The following hypothetical example of a ship handling tug life cycle cost summary indicates the CAPEX – OPEX relationship for two fuel efficiency scenarios for the same operating profile. Owners business case factors define expected escalation rates and net present value discount. This is but one of many tools for use in cost effective tug design.

20 year CAPEX - OPEX Cost Summary for 80t Ship Assist Tug

	Escalated @ 3%	Escalated @ 3% and NPV discounted @ 10%	Escalated @ 3%	Escalated @ 3% and NPV discounted @ 10%
	Base Design	Base Design Present Value	Higher Efficiency	Higher Efficiency Present Value
CAPEX	$15,000,000	$15,000,000	$15,600,000	$15,600,000
OPEX-Fuel	$23,800,000	$9,300,000	$20,800,000	$8,100,000
OPEX- Lube	$1,000,000	$400,000	$960,000	$370,000
OPEX-Maintenance	$10,300,000	$3,800,000	$10,600,000	$3,900,000
TOTAL	**$50,100,000**	**$28,500,000**	**$47,960,000**	**$27,870,000**

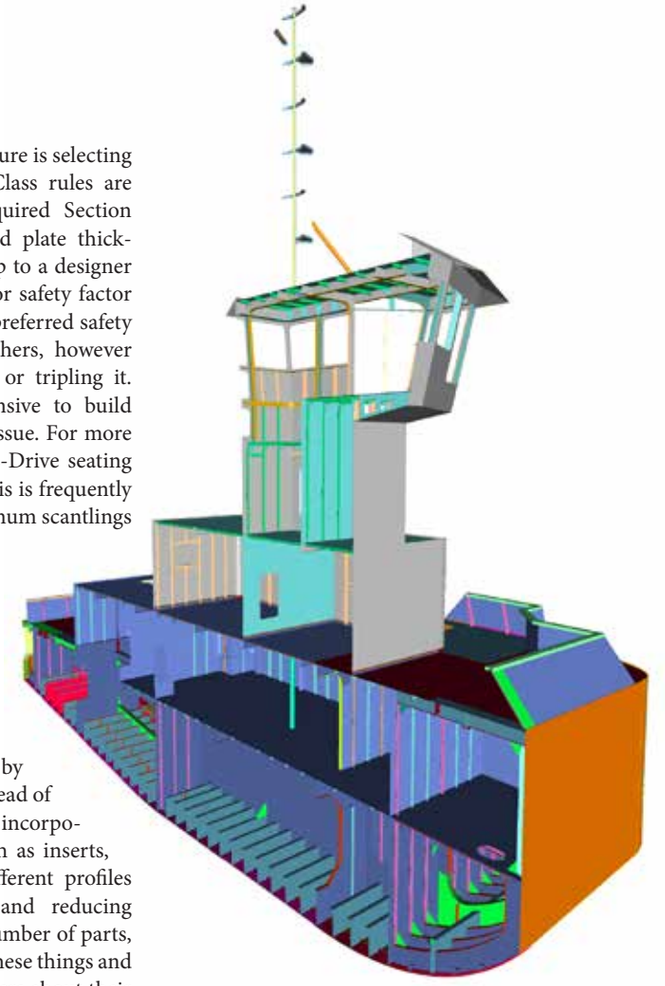
Optimizing Structure

by: Dmitry Kapiturov
Technical Manager, Production Design

At Robert Allan Ltd. we want our boats to be strong, durable, well-built and able to sustain the expected stress loads to be encountered during their life span. We also want our Owner clients to spend their money wisely and the shipyards to be able to build within a predictable budget. Designing ships is all about finding compromises between many different things; one of them being optimizing structure in order to meet Class, owner, shipyard and our own requirements.

The first step in designing structure is selecting scantlings. No matter which Class rules are used, once the minimum required Section Modulus or minimum required plate thickness has been calculated, it is up to a designer to decide what design margin or safety factor to select. For certain areas, the preferred safety factor is 1.35, and 1.15 for others, however there is no sense in doubling or tripling it. Heavier boats are more expensive to build and vessel weight is always an issue. For more complex structures such as a Z-Drive seating or staple, Finite Element Analysis is frequently performed, identifying the optimum scantlings for the required structure.

Simplifying structure is another factor that can potentially save costs in building. Examples of such applications are: flanged plates instead of built-up T-Sections for webs and girders if allowed by Class, thicker plate brackets instead of thinner brackets with a flange, incorporation of structural fittings such as inserts, minimizing the number of different profiles and plate thicknesses used, and reducing wherever possible the overall number of parts, etc. We always pay attention to these things and consult with shipyards and owners about their preferences.



Production Design Model of 25m Push Tug for ITB Marine Group Ltd.

Once at the production design stage, there are also many factors which need to be optimized. While breaking down shell, decks or bulkheads into parts, it is very important to know raw material sizes available to the shipyard in order to minimize the length and number of welded seams and, at the same time, increase utilization of the nested plates. Most of the production design software products available today do a good job with automatic nesting, however once it is completed, an experienced designer can easily identify if some adjustment within nesting drawings could save a plate sheet or two. Cutting machines are also getting better and better nowadays: mark/reference lines and part names can be done during the cutting process and a high degree of accuracy is attainable. Our production designers add as much information as possible to plate parts that will be useful during the construction.

Of course communication with shipyards is very important. The early preparation of a well-defined build strategy and clear definition of desired assembly blocks that follow the yard's build sequences will save a lot of time and money during the construction. Modelling the structure in 3-D enables the designer to visualize how pieces of structure can be assembled before actual construction takes place, and if necessary make changes within the build sequence to prevent potential issues during the construction process.

Designing boats is a very complex task and to make a success of it one must make a lot of good and timely decisions during the design process, finding the best compromise that will allow us to design and the shipyard to build a successful boat.

Tug Construction – an Historical Perspective

by: Rollie Webb
Senior Vice President

In our working careers we all normally remember words of wisdom passed on to us by our elders. One of the pithy quotes that have stuck with me for many years originated from a seasoned and well scarred shipbuilder who took pity on my naïve perception of how lucrative the industry must be. His advice was simple; "The only way to make a little money in shipbuilding is to start with a lot"! Not very reassuring but unfortunately and too frequently this prediction turns out to be true! Historically, shipbuilding was thought of as a vocation of true craftsmanship, more of an art than science. Every shipbuilder worth his salt had a unique way of estimating his costs and from that arriving at his price. These methods were all held very closely and rarely if ever discussed in public. Arthur McLaren, a well-known and respected deceased Canadian shipbuilder of the Wartime generation was once quoted as saying "you can ask me about my love life or anything else but not about how I estimate the cost of ship".

This old school approach to cost estimating, very reliant on the experience or memory of a small handful of people is now a dangerous and short-sighted approach to the problem. Ship building and ship design have changed so much in recent years that historical practices such as focusing on steelweight is just not enough. A far greater area of risk is the weight, cost and complexity of the electrical systems to be installed. A close runner up is the sophistication of the paint system being applied. Factors such as steelweight, paint and cable quantities are all important but for a modern day shipbuilder to really understand his costs he needs to define, understand and optimize his processes, utilize standard components wherever possible, reduce the number of parts involved and truly organize the work.

During the Second World War many non-shipbuilders turned their attention to the construction of the myriad of vessels required for the war effort. One very relevant example of this effort was the requirement to produce hundreds of what were known as "invasion tugs", desperately needed in the crowded ports of the United Kingdom in the lead up to D-Day. Companies in the UK, the USA and Canada all applied themselves to the task. One of the most prolific firms was a bridge building company based in Trenton, Ontario. Central Bridge Co. produced a total of 146 of these tugs in just over two years! In the winter of 1943/44, at the peak of production, a new tug was delivered daily. The shipyard was not on the water and had never built anything that floated, but they diligently and successfully applied the simple principles of industrial engineering to the process of mass producing these useful little vessels. The tugs

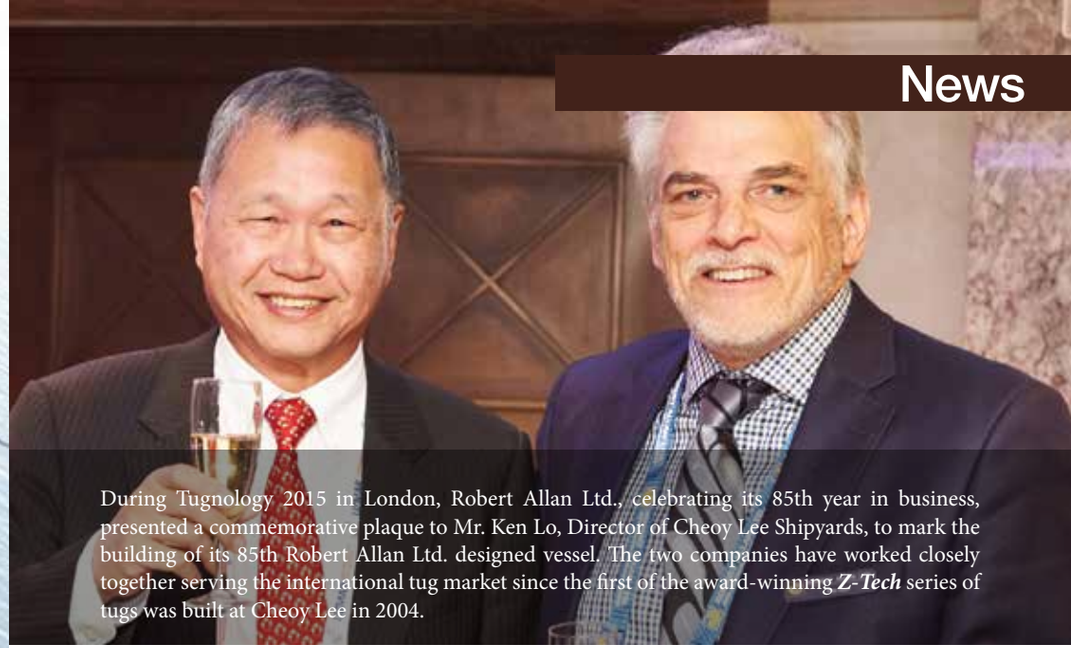
continued...

left the yard on a railcar, heading for tidewater to be loaded as deck cargo for the ocean voyage.

The average price per unit was under $70,000 and actually dropped with each successive order. The first version was fitted with a 240 bhp diesel engine while later units were real power houses with a 260 bhp engine being installed. Many of these tugs were in service well into the 1990's and even beyond.

Today a few fortunate and well organized shipyards have the luxury of something close to series production of similar but rarely identical vessels. While the product is not identical the processes and design details involved have been optimized, rationalized and continually improved. One very good example of such a modern tug building facility is the original Sanmar facility in Tuzla, Turkey. Sanmar has delivered 130 Robert Allan Ltd. tugs from this and similar sites in 25 years and 34 more vessels are scheduled to be delivered till the end of 2017. Shipbuilding is indeed a science.

News



During Tugnology 2015 in London, Robert Allan Ltd., celebrating its 85th year in business, presented a commemorative plaque to Mr. Ken Lo, Director of Cheoy Lee Shipyards, to mark the building of its 85th Robert Allan Ltd. designed vessel. The two companies have worked closely together serving the international tug market since the first of the award-winning ***Z-Tech*** series of tugs was built at Cheoy Lee in 2004.

Six ***RAstar*** Tugs for Svitzer

The world leading towage specialist Svitzer has awarded a contract for six Robert Allan Ltd. designed ***RAstar 2800*** Class ASD escort/terminal tugs to the innovative Turkish Shipbuilder Sanmar, operators of two custom-built, modern shipyards located in Tuzla and Altinova, Turkey. Svitzer's Kristian Brauner noted "these new tugs are key" to its growth strategy, and that the company chose Sanmar "due to their outstanding safety performance and construction quality".

RT Investigator Discovery

RT Investigator, Australia's new oceanographic research vessel, discovers extinct volcanoes about 250km off the NSW coast. ***RT Investigator*** was designed by RALion (a joint venture between Robert Allan Ltd., Alion Science and Technology of Alexandria, Virginia and Alion Canada of Ottawa).

In August of this year, Seaspan Marine of Vancouver, B.C. took delivery of their new 16,000 DWT deck cargo barge ***Seaspan 252***. Constructed by Seabridge Marine Contractors Ltd. at Jiangsu Yanzijiang Shipbuilding Co. Ltd. in China, the barge crossed the Pacific under tow of the tug ***Pacific Hickory***. At 114 m long by 27.5 m wide with a depth of 8.4 m and classed ABS +A1 Barge, the ***Seaspan 252*** was purpose-designed for its task of hauling limerock from Texada Island to Portland, Oregon and Seattle, Washington. This is the third generation of barge designed by Robert Allan Ltd. for Seaspan for this same service. The first barges, ***Island Importer*** and ***Island Exporter*** (later ***Seaspan 240*** and ***Seaspan 241***) were designed in 1959, and were among the very first ocean-going bulk cargo barges in North America.

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On the cover is Uzmar's shipyard in Turkey showing including several ***RApide*** and ***RAmparts*** tug designs.

This issue uses QR Codes to allow quick access to some web links. It does require a QR Code app on your mobile device.

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